Visibility-derived aerosol optical depth over global land from 1980 to 2021

Response to Referee #4.

Comments:

The authors have addressed most comments raised by previous reviewers.

The authors also added confidence intervals to the gridded dataset based on Kriging Variance in responds to previous reviewers' comments on accuracy of the extrapolation in data sparse regions.

I have several issues with this approach:

comment 1. Kriging is a smooth estimator, which means that it presents a smooth spatial interpolation between observations/ station estimates, whereas AOD is often impacted by small scale phenomena, which are not represented in the observational dataset for data sparse region. This means that Kriging is likely to be a not ideal method for creating a gridded data product and that CIs based on Kriging variance, will therefore underestimate the TRUE uncertainty.

comment 2. Therefore, adding Kriging variance-based CIs to the dataset that do not include a very important source of variation/ uncertainty have the potential to give naive data users false confidence in the gridded product. To illustrate this issue, there are large deviations in meridional AOD between the gridded product and MODIS at -120 W and 0E (Figure 11, note the label error in the figure), but Figure 10 indicates very high confidence in the result (green, CI ~ 0.02?). This clear inconsistency indicates to me a problem with the approach.

Response to comment 1 and comment 2:

- Thank you for your suggestion. We have removed the gridded data product in this study, and made corresponding modifications based on station data product in Section 3.4 and Section 3.5. And We also have checked and modified the content of the manuscript.